

REMARKS

The Examiner has rejected claims 1-2, 6, 7, 9-19, 26-40, 43, 45-49, 53, 55, 57-64, 67-70, 73, 74, 77-89 and 92-111 are under 35 U.S.C. §103(a) as being unpatentable over combinations of references that include Yao et al. U.S. Patent No. 6,051,114 (hereinafter “Yao”) and Yasar et al. U.S. Patent Application Publication No. 2003/0034244 (hereinafter “Yasar”).

Applicant is canceling all claims except claims 32, 33 and 94, which are being rewritten in independent form with no other changes. These claims have been rejected as unpatentable over Yao in view of Yasar. Reconsideration is requested for the reasons stated below.

In addition, claims 60 and 80 have been amended to depend on the now independent claims 33 and 32, respectively, to specify that the barrier layer is ruthenium.

The present invention relates to ionized physical vapor deposition (IPVD) performed with a high-density inductively coupled plasma and a process useful for depositing ultra thin barrier and seed layers onto the surfaces of sub-micron, high aspect ratio features on substrates. The process includes the simultaneous depositing of material and the etching of the deposited material. This simultaneous process is accomplished by directing ions of the material onto the substrate for deposition while directing ions of gas onto the substrate for etching.

Yao deals with IPVD using a microwave ECR plasma to totally fill vias and trenches with metal, which is a process that would follow any process for depositing barrier or seed layers. Yao uses the directional IPVD to fill features while etching at the overhangs to prevent closing of the feature before the feature is filled.

The present invention deals with the entirely different problem of applying an ultra thin coating in the features, primarily on their sidewalls. While aspects of the solution are the same as Yao’s, the use of those aspects and the others claimed by Applicant to effectively coat feature sidewalls is unobvious. Yao notes in column 2, lines 40-49, of his patent that his invention applies to a fill process performed after a barrier layer is applied by conventional CVD. If it were obvious to Yao to use his invention for barrier layer application, he would not have used a very

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expensive additional module for the barrier layer process. Applicant's methods are not concerned with creating voids due to shadowing by overhangs, but in facilitating redistribution of barrier layer and seed layer material in the features.

Yasar deals with a problem that is more similar to Applicant's than is that of Yao. However, Yasar uses sequential deposition and etching and discusses how the process parameters are to be maintained entirely differently during the deposition steps than during the etching steps. Yasar uses higher deposition rates and higher pressures during its deposition step, and these parameters are incompatible with simultaneously etching.

It is submitted that the final rejection does not present a case of the obviousness of claims 32, 33 and 94. Accordingly, such claims should be allowed. For the same reason, claims 60 and 80 should be allowed.

Applicant believes that no fee is due with this Amendment. If any additional charges or credits are necessary to complete this communication, please apply them to Deposit Account No. 23-3000.

Respectfully submitted,

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